

other modes of stimulation, have the same seat, and that the opposition between them is in accordance with a principle applicable in common to the excitable structures of plants and animals, viz., that the *property which renders a structure capable of undergoing excitatory change is expressed by relative positivity, the condition of discharge by relative negativity.*

With reference to the mode of action of the voltaic current, the effect produced in the unexcited leaf is compared with that observed in the unexcited electric organ of the skate or the torpedo, in both of which, as in the leaf, it is observed that, although the after-effect of a current led across the disks or plates is to increase the difference of potential between its two surfaces, whichever way the current is directed, the effect is much greater when the direction of the external current coincides with that of the normal electromotive action of the organ than in the opposite case.

It is further shown that the electromotive changes concerned in "modification" and "excitation" have their seat at the upper surface of the lamina. If, as the author believes, all these changes depend on difference of physiological activity between adjacent excitable cells or strata of cells of which the protoplasmic linings are in continuity, it must be supposed that when the leaf is at its prime, the most superficial strata are positive to those subjacent, and that as the former lose their pristine susceptibility of excitatory change, the physiological, and consequently the electrical, difference between them is diminished, annulled, or reversed.

The fourth section of the paper is devoted to an investigation made in 1887, of the events of the first second after excitation made with the aid of a pendulum-rheotome specially adapted for the purpose. The fifth contains the description of the records obtained by photographing the electric phenomena of the excitatory reaction, as observed with the aid of the capillary electrometer, on rapidly moving plates. Both of these series of observations serve to confirm and complete the results obtained by other methods.

II. "Magnetic Qualities of Nickel." By J. A. EWING, F.R.S., Professor of Engineering, University College, Dundee, and G. C. COWAN. Received April 26, 1888.

(Abstract.)

The experiments described in the paper were made with the view of extending to nickel the same lines of enquiry as had been pursued by one of the authors in regard to iron ('Phil. Trans.,' 1885, p. 523). Cyclic processes of magnetisation were studied, in which a magnetising

force of about 100 c.g.s. units was applied, removed, reversed, again removed, and re-applied, for the purpose of determining the form of the magnetisation curve, the magnetic susceptibility, the ratio of residual to induced magnetism, and the energy dissipated in consequence of hysteresis in the relation of magnetic induction to magnetising force. Curves are given, to show the character of such cycles for nickel wire in three conditions: the original hard-drawn state, annealed, and hardened by stretching after being annealed. The effects of these have also been examined (1) by loading and unloading magnetised nickel wire with weights which produced cyclic variations of longitudinal pull, and (2) by magnetising while the wire was subjected to a steady pull of greater or less amount. The results confirm and extend Sir William Thomson's observation that longitudinal pull diminishes magnetism in nickel. This diminution is surprisingly great: it occurs with respect to the induced magnetism under both large and small magnetic forces, and also with respect to residual magnetism. The effects of stress are much less complex than in iron, and cyclic variations of stress are attended by much less hysteresis. Curves are given to show the induced and residual magnetism produced by various magnetic forces when the metal was maintained in one or other of certain assigned states of stress; also the variations of induced and residual magnetism which were caused by loading and unloading without alteration of the magnetic field. Values of the initial magnetic susceptibility, for very feeble magnetising forces, are stated, and are compared with the values determined by Lord Rayleigh for iron, and the relation of the initial susceptibility to the stress present is investigated. The paper consists mainly of diagrams in which the results are graphically exhibited by means of curves.

III. "On the present Position of the Question of the Sources of the Nitrogen of Vegetation, with some new Results, and preliminary Notice of new Lines of Investigation." By Sir J. B. LAWES, F.R.S., and J. H. GILBERT, M.A., LL.D., F.R.S., Sibthorpean Professor of Rural Economy in the University of Oxford. Received, Part I, July 20, 1887. Parts II and III, May 3, 1888.

[For Preliminary Notice of this Paper, see vol. 43, p. 108.]